**1.3**

**Finding Zeros and End Behavior of Polynomial Functions**

**Zeros of Polynomial Functions**

**Finding zeros by factoring:**

Recall that finding the real-number zeros of a function *f* is equivalent to finding the *x*-intercepts of the graph of *y = f(x)* or the solutions to the equation *f(x)* = 0. The example below illustrated that factoring a polynomial function makes solving these three related problems relatively easy.

**Example:**

Find the zeros of .

**Solution:**

We solve the related equation *f(x)* = 0 by factoring.



So the zeros of *f* are 0, 3 and -2.

**Finding Zeros Using the Remainder Theorem & Factor Theorem:**

**Remainder theorem:** If a polynomial *f(x)* is divided by *x – k,* then the remainder *r = f(k).*

Example:

Find the remainder when  ** is divided by x – 2.



The remainder is 6.

So, now the question we ask is: Is x – 2 a **factor** of **?

The answer is **no** because the remainder was not zero.

**Factor Theorem:** A polynomial function *f(x)* has a factor *x - k* if and only if *f(k)* = 0.

**Example using the Remainder Theorem:**

Find the remainder when is divided by

1. x – 2 b) x + 1 c) x + 4

**Solution:**

1. Using the Remainder Theorem with *k* = 2 we find that

.

1. 
2. 

Because the remainder in part c) is 0, x + 4 divides evenly into . So, it is a factor of , and -4 is a solution of . -4 is also an x-intercept of the graph of .

**Fundamental Theorem of Algebra:**  A polynomial function of degree *n* has *n* complex zeros (real and nonreal). Some of the zeros may be repeated.

Examples: See page 15 Practice Exercises C

**Power Function Graphs and End Behavior**

See pages 11-14